Weir

TEST FILE

Technical Information

MADGE TEST

MULTIREG 731, 732

MAXIREG 761, 762

WEIR INSTRUMENTATION LIMITED
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MULTIREG 731,732
MAXIREG 761,762

GENERAL

The Multireg and Maxireg series of regulated power supplies are identical in circuit configuration except that the series control elements are doubled in the Maxireg to provide additional power handling capacity; extra reservoir capacitors are added in Maxireg 761 to handle the extra current.

Each unit contains two separate supplies of equal rating, one of which is regulated by comparison with the other. These two supplies can be connected in series or parallel by the mode switch, to provide three possible output configurations.

OPERATING INSTRUCTIONS

These units are despatched to the U.K. market with the transformer tappings wired for 240V a.c. and will work satisfactorily from line voltages within the specification limits of ±10%. Primary tappings are provided for line voltages of 220V, 230V, 110V and 120V a.c. and when these line voltages are required, the primary linking should be modified as shown on Page 3. To obtain access to the transformer, unscrew the two screws in the underside of the case and withdraw the supply. The transformer taps are then readily accessible except in Maxireg 761, where two capacitors (C5 and C6) must first be removed.

The captive power lead from the instrument should be connected to a suitable plug, using the conventional colour code: brown = live, blue = neutral, green/yellow = earth.

The output voltage range is selected by the mode switch. When the higher voltage range is chosen, the two supplies are connected in series and the centre tap terminal is connected to the junction of the supplies. The output is thus available as a single output at the full rated voltage or as two supplies at half voltage, symmetrically about the centre tap. When the lower voltage range is chosen, the two supplies are connected in parallel and the centre tap terminal has an output impedance of 5kΩ. In either configuration, any one of the terminals may be earthed to determine the polarity of the output.

The output voltage is set to the required level by the voltage limit control which is calibrated to ±3%. Greater accuracy may be obtained by setting the output voltage against the internal meter or an external digital voltmeter. Constant current limiting protects the supplies against overload damage even when a short circuit occurs across the output terminals. The output at which current limiting commences is determined by the current limit control. This control may be set up against the internal meter by selecting a low output voltage, short circuiting the output terminals and setting the control to the required level. In the centre tapped mode, the voltage and current limit controls operate equally on each half of the supply. A switch associated with the meter selects monitoring of the total output voltage, positive line current and negative line current.

To obtain extra power, higher voltage levels than those provided or multiple output rails, several of these supplies may be connected in parallel or series. In the parallel configuration, current sharing may not be exact, due to inaccuracies in setting up the output voltage of the several supplies, but the current limiting action will ensure that none of the supplies are overloaded while the stablising action will be maintained by the supply delivering the lowest output voltage. Fine adjustment of voltage may be made while the supplies are driving the load, to ensure that the best possible load sharing is achieved.

NOTE: To maintain adequate cooling of the heat sinks, a free circulation of air is required and these supplies should not be stacked if delivering more than 50% of their rated output power.

Weir Instrumentation Limited

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TECHNICAL DESCRIPTION

The block schematic diagram shows the principle on which these power supplies operate. Power is drawn from the a.c. supply through a single transformer with two secondary windings. These supply two rectifier and filter circuits to produce two entirely separate d.c. power sources, each of which feeds a series control element.

In the parallel mode, the output voltage is compared with a fixed reference in the voltage limit amplifier to provide a control signal which is coupled through the gate and buffer amplifier to drive both series control elements.

The constant current supply forms a high dynamic impedance load for the buffer amplifier, ensuring maximum gain from the control loop.

In the series mode, the total output voltage is compared with the fixed reference to provide the control signal for one supply. The outputs of the two supplies are compared in the comparator amplifier to provide a control signal for the second supply.

The current limit amplifier compares the output current with a current reference and when the preset current is reached, takes control of one or both of the series elements, causing the output voltage to fall at constant current as the load resistance falls.

The a.c. input supply is fused and a single pole ON/OFF switch is fitted in the live side. The transformer has two identical 120V primary windings tapped at 110V. These may be connected in parallel or series for operation from line voltages of 110V, 120V, 220V, 230V and 240V, ±10%, 50-60Hz. Tap changing is done by re-soldering the linking on the transformer primary. A gas-filled indicator lamp is connected across one primary to indicate when the power is switched on.

The transformer has two identical centre-tapped secondary windings, the outputs from which are full-wave rectified to provide the d.c. power sources. A single reservoir capacitor, C1 or C2, is used for each except on Maxireg 761, which has two capacitors in parallel for each source.

The upper supply on the circuit diagram provides the more positive supply in the series configuration and will be designated supply A, the other being supply B.

The constant current is drawn from supply A through transistor VT104, the base potential of which is referred to supply A positive by the voltage dependent resistor VDR101. The collector of VT104 provides a high impedance, constant current source to the base of VT107.

The series control element consists of an emitter follower which uses one transistor in Multireg and two transistors in parallel in Maxireg (supply A, VT401 and VT403; supply B, VT402 and VT404). The series element is driven by a further emitter follower (VT107 or VT109) forming a compound emitter follower with a high current gain.

The voltage reference supply is obtained from the secondary winding of supply B through the half-wave rectifier MR211. It is smoothed by the reservoir capacitor C204 and is initially shunt stabilised by R213 and zener diode MR209. This stabilised voltage feeds the constant current transistor VT209, the base of which is held at constant voltage by zener diode MR212. The resultant stabilised current is applied to the reference zener diode MR213, thus generating a highly stable reference.

This negative reference is compared with the most positive output in a resistor chain consisting of RV1, RV203 and R221 in the parallel mode. In the series mode, RV204 and R222 are connected in parallel with RV203 and R221. The current in this resistor chain is constant, drawn from the reference supply. Thus, as the value of RV1 is varied, the volt drop across it will change, providing the output voltage control.

The signal at the junction of RV1 and RV203 is coupled to the base of VT208, the voltage limit amplifier. This amplifier provides the voltage control signal to the series element of supply A and, in the parallel mode, supply B also, in such a way as to oppose any output voltage fluctuations due to changes in supply voltages or load.

The output of VT208 drives the base of the gating emitter follower VT204 which in turn is coupled to the base of the drive emitter follower VT107 and, in the parallel mode, VT109 also.

The comparator amplifier only operates in the series mode. It consists of an emitter coupled differential amplifier VT102, VT103. The base of VT102 is connected to the centre tap of the two supplies, while the base of VT103 is connected to a resistor chain R108, RV101, R109, connected between the positive and negative outputs. RV101 is preset to exactly balance the two supplies. Any fluctuation in one of the supplies will then generate an unbalance signal which is amplified and coupled to the series element of supply B, to oppose the initial fluctuation. The output of the comparator amplifier is taken from the collector of VT103 to the base of VT101, a further amplifier which controls the drive to the base of VT109.

The current reference is drawn through half-wave rectifier MR201 from the transformer winding which provides supply A. Reservoir capacitor C201 provides smoothing and the supply is then shunt stabilised by R201 and zener diode MR202. The supply is further stabilised by R202 and zener diode MR203. This negative supply then provides current to the emitters of VT102 and VT103 and a reference potential to the emitters of VT201, VT202 and the base of VT106.

The current limiting amplifier consists of VT201 and VT202. These are connected as two separate current detectors having similar circuit configurations. VT201 operates on the current in the negative of supply A and provides control in the series and parallel modes. VT202 operates on the current in the positive of supply B and provides control in the series mode only. In the parallel mode, the emitter is elevated to the positive output potential, holding VT202 cut off.

As the circuits are similar, the operation of VT201 will be described. The base of VT201 is connected to a resistor chain consisting of RV2/a, R206 and RV202 across the reference potential. The emitter of VT201 is connected to the current sensing resistor R217. Thus, a proportion of the volt drop across R217, determined by the setting of the current limit control RV2, provides the base emitter signal of VT201. At load currents less than the preset limit, the d.c. bias from RV2 will hold VT201 cut off. At the preset limit, however, the emitter of VT201 will move negative with respect to the base and the transistor will conduct. The collector current flows into the base of the gating emitter follower VT203. When VT203 conducts, it draws current from the constant current transistor VT104 and thus starves the base of VT107 and VT109 of current. This causes the output voltage to fall as the voltage limit amplifier cuts off.

The transistor VT106 is normally cut off. It conducts when the current reference supply collapses, cutting off the series control elements. This prevents any risk of an output voltage surge when the supply is switched on or off.

SETTING-UP PROCEDURE

NOTE: The letters in parenthesis throughout the procedure indicate differences between the four supplies described in this leaflet; they refer to Table 1.

The output voltages in the text are measured by an external meter across the relevant output terminals and not by the internal meter, except where stated. A digital voltmeter will give conveniently accurate results.

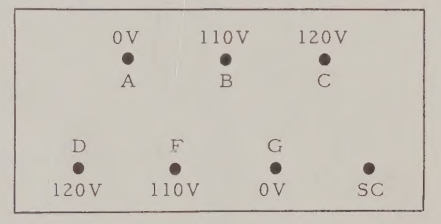
Set the mode switch to (A) output. Adjust RV1 to give an output voltage of (B) and fit the voltage limit knob with its pointer at (B) setting. Adjust RV1 to (C) setting and adjust RV203 to give (C) output voltage. Set the mode switch to (D) output and adjust RV204 to give (E) output. Adjust RV1 to give an output of (D) and adjust RV206 to give (D) on the internal meter. Adjust RV101 to provide a centre tapped output of ±(A) ±30mV. Check the linearity of the voltage limit setting, the meter reading and tracking of the centre tap (0·1%). Connect a current meter between the CT and +ve terminals; rotate RV2 from fully anti-clockwise position until the current first starts to rise, Fit the current limit knob with its pointer at zero. Adjust RV2 to (F) setting and adjust RV202 until the current is (G). Connect the current meter between CT and −ve terminals; adjust RV201 until the current is (G). Switch to (A) output, connect the external meter between +ve and −ve terminals. Adjust RV2 to give (H). Check the position of the knob. Adjust RV205 for correct internal meter reading on +A range and RV207 for correct internal meter reading on −A range. Check the linearity of the current meter readings.

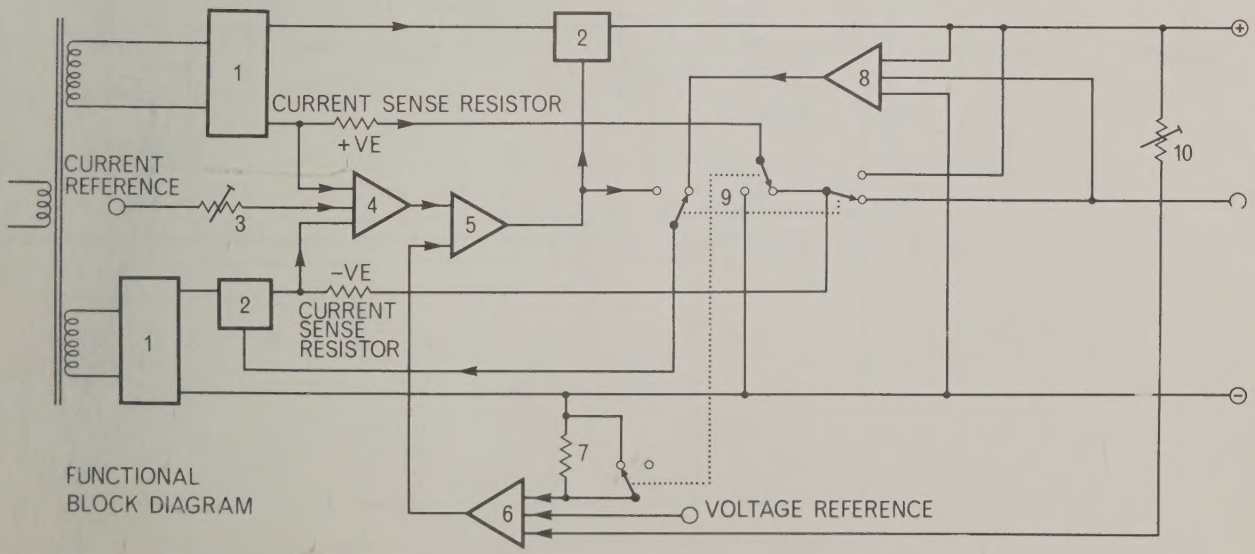
TABLE 1

	731	732	761	762
(A)	15	30	15	30
(B)	2.5	5	2.5	5
(C)	12.5	25	12.5	25
(D)	30	60	30	60
(E)	25	50	25	50
(F)	1	0.5	2	1
(G)	1.01	0.505	2.02	1.01
(H)	2	1	4	2

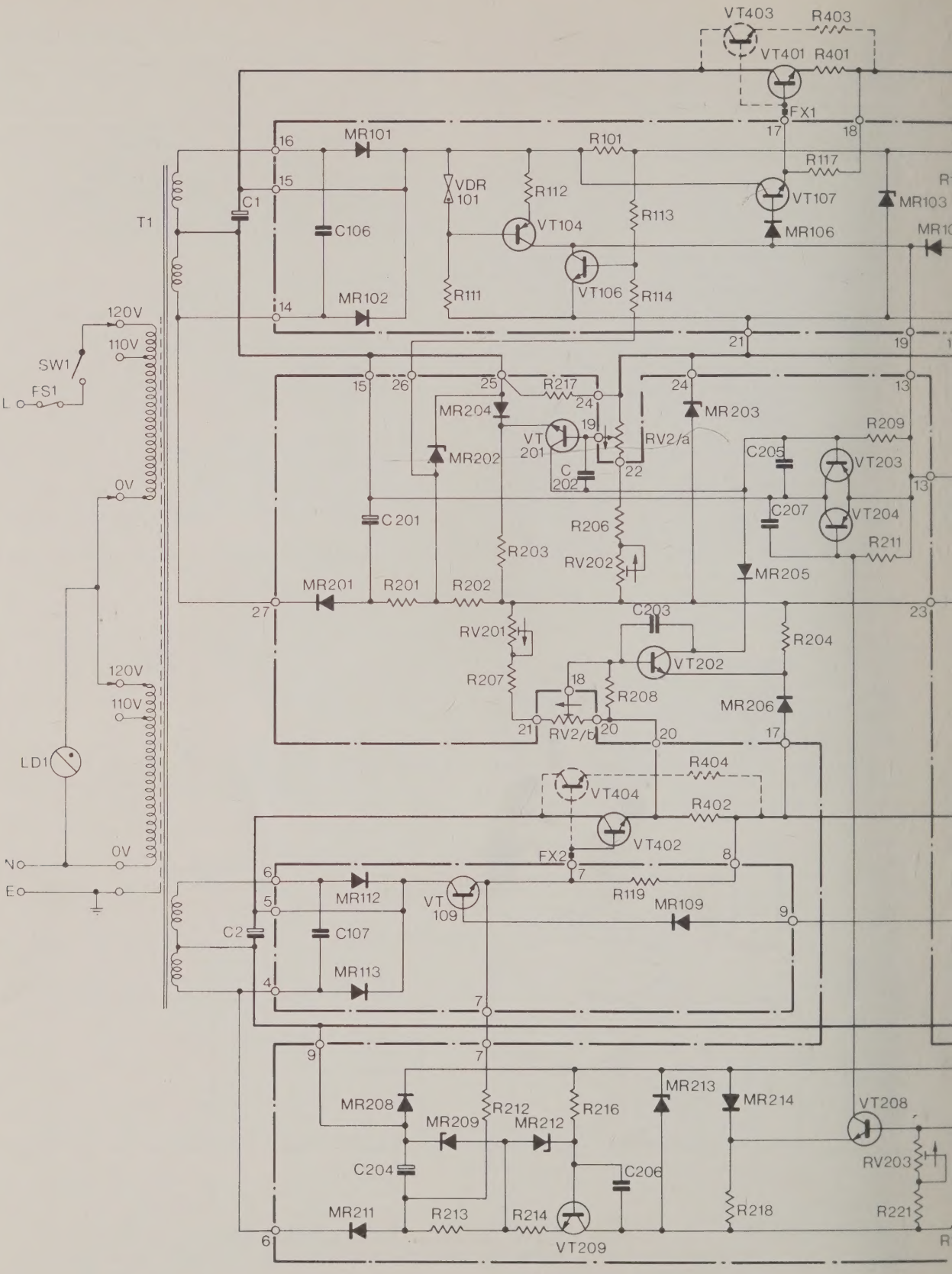
TRANSFORMER PRIMARY LINKING

Supply	Link	L (Brown)	N (Blue)
240V	G to C (0 to 120V)	D (120V)	A (0V)
230V	G to B (0 to 110V)	D (120V)	A (0V)
220V	G to B (0 to 110V)	F (110V)	A (0V)
120V	A to G, C to D (0 to 120V)	D (120V)	A (0V)
110V	A to G, B to F (0 to 110V)	F (110V)	A (0V)

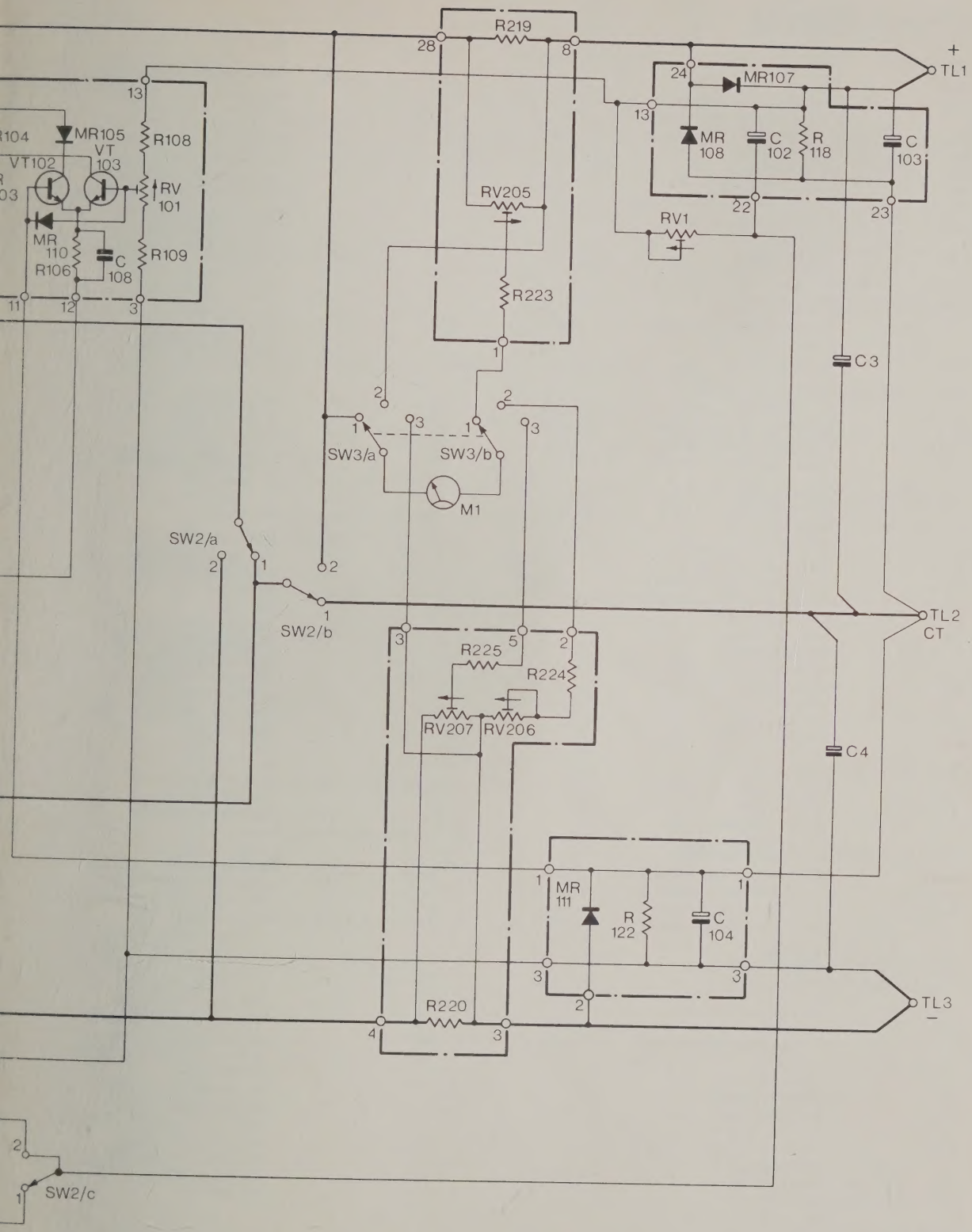




1. Rectifier and Filter
2. Series Regulator
3. Current Limit Adjust
4. Current Limit Amplifier
5. Gate and Buffer Amplifier
6. Voltage Limit Amplifier
7. Voltage Range Resistor
8. Comparator Amplifier
9. Mode Switch
10. Voltage Limit Adjust



Circuit Diagram - relevant to all four instruments.



Components shown dotted do not appear in some instruments - see parts lists.

PARTS LIST

Power Supply Multireg 731

Circuit Ref.	Description	Value	Rating	Tol.	Part No.
RV1	Resistor Variable	6k	3W	10%	Colvern CLR4001
RV2	Resistor Variable	10k +10k	1W		Reliance MW 10k +10k
C1, C2	Capacitor Electrolytic	3300μF	40V		Mullard 071-17332
C3, C4	Capacitor Electrolytic	100μF	40V		Mullard 016-17101
T1	Transformer				MEP/Telio W0705
SW1	Switch Toggle				Arcolectric BC603C
SW2	Switch Toggle				Waycom MST405N
SW3	Switch Lever, 2p, 3 way				Lorlin/Diamond H W0722
LP1	Neon Indicator, Red		110V		Arcolectric SL267
	Holder				Belling Lee E6011
FS1	Fuse, link		2A		Belling Lee L1427/2
M1	Meter				W0713

Heat Sink Assembly

R401, 402	Resistor Wire Wound	1·2Ω	2½W	5%	Welwyn W21
VT401, 402	Transistor				2N3055
FX1, FX2	Ferrite Bead				Mullard FX1115

Special Resistors on PCB W0683

R213	Resistor Wire Wound	560Ω	2½W	5%	Welwyn W21
R217	Resistor Wire Wound	1·2Ω	2½W	5%	Welwyn W21
R223, 225	Resistor Metal Oxide	150Ω	½W	5%	477-1-150Ω
R224	Resistor Metal Oxide	27k	½W	5%	477-1-27k

Power Supply Multireg 732

Circuit Ref.	Description	Value	Rating	Tol	Part No.
RV1	Resistor Variable	12k	3W	10%	Colvern CLR 4001
RV2	Resistor Variable	10k +10k	1W		Reliance MW 10k +10k
C1, 2	Capacitor Electrolytic	1500μF	63V		Mullard 071-18152
C3, 4	Capacitor Electrolytic	100μF	40V		Mullard 016-17101
T1	Transformer				W0706
SW1	Switch Toggle				Arcolectric BC603C
SW2	Switch Toggle				Waycom/MST405N
SW3	Switch Lever, 2p, 3 way				Lorlin/Diamond H W0722
LP1	Neon Indicator, Red		110V		Arcolectric SL267
	Holder				Belling Lee E6011
FS1	Fuse, link		2A		Belling Lee L1427/2
M1	Meter				W0714

Heat Sink Assembly

R401, 402	Resistor Wire Wound	2·2Ω	2½W	5%	Welwyn W21
VT401, 402	Transistor				2N3055
FX1, FX2	Ferrite Bead				Mullard FX1115

Special Resistors on PCB W0683

R213	Resistor Wire Wound	820Ω	2½W	5%	Welwyn W21
R217	Resistor Wire Wound	2·2Ω	2½W	5%	Welwyn W21
R223, 225	Resistor Metal Oxide	56Ω	½W	5%	477-1-56Ω
R224	Resistor Metal Oxide	56k	½W	5%	477-1-56k

Power Supply Maxireg 761

Circuit Ref.	Description	Value	Rating	Tol.	Part No.
RV1	Resistor Variable	6k	3W	10%	Colvern CLR 4001
RV2	Resistor Variable	10k +10k	1W		Reliance MW 10k +10k
C1, 2	Capacitor Electrolytic	3300μF	40V		Mullard 071-17332
C3, 4	Capacitor Electrolytic	250μF	40V		Mullard C437AR/G250
T1	Transformer				W0709
SW1	Switch Toggle				Arcolectric BC603C
SW2	Switch Toggle				Waycom MST405N
SW3	Switch Lever, 2p, 3 way				Lorlin/Diamond H W0722
LP1	Neon Indicator, Red		110V		Arcolectric SL267
	Holder				Belling Lee E6011
FS1	Fuse, link		3A		Belling Lee L1427/3
M1	Meter				W0716

Heat Sink Assembly

R401, 402	Resistor Wire Wound	1·2Ω	2½W	5%	Welwyn W21
R403, 404	"				
VT401, 402	Transistor				2N3055
VT403, 404	"				
FX1, FX2	Ferrite Bead				Mullard FX1115

Special Resistors on PCB W0683

R213	Resistor Wire Wound	560Ω	2½W	5%	Welwyn W21
R217	Resistor Wire Wound	2 x 1·2Ω	2½W	5%	Welwyn W21 (in parallel)
R223, 225	Resistor Metal Oxide	330Ω	½W	5%	477-1-330Ω
R224	Resistor Metal Oxide	27k	½W	5%	477-1-27k

Power Supply Maxireg 762

Circuit Ref.	Description	Value	Rating	Tol.	Part No.
RV1	Resistor Variable	12k	3W	10%	Colvern CLR 4001
RV2	Resistor Variable	10k +10k	1W		Reliance MW 10k +10k
C1, 2	Capacitor Electrolytic	1500μF	63V		Mullard 071-18152
C3, 4	Capacitor Electrolytic	250μF	40V		Mullard 437AR/H250
T1	Transformer				W0708
SW1	Switch Toggle				Arcolectric BC603C
SW2	Switch Toggle				Waycom/MST405N
SW3	Switch Lever, 2p, 3 way				Lorlin/Diamond H W0722
LP1	Neon Indicator, Red		110V		Arcolectric SL267
	Holder				Belling Lee E6011
FS1	Fuse, link		3A		Belling Lee L1427/3
M1	Meter				W0715

Heat Sink Assembly

R401, 402	Resistor Wire Wound	2·2Ω	2½W	5%	Welwyn W21
R403, 404	"				
VT401, 402	Transistor				2N3055
VT403, 404	"				
FX1, FX2	Ferrite Bead				Mullard FX1115

Special Resistors on PCB W0683

R213	Resistor Wire Wound	820Ω	2½W	5%	Welwyn W21
R217	Resistor Wire Wound	1·2Ω	2½W	5%	Welwyn W21
R223, 225	Resistor Metal Oxide	150Ω	½W	5%	477-1-150Ω
R224	Resistor Metal Oxide	56k	½W	5%	477-1-56k

Amplifier PCB W0683

Circuit Ref.	Description	Value	Rating	Tol.	Part No.
Resistors					
R201	Wire Wound	1k2	2½W	5%	Welwyn W21
R202	Metal Oxide	470Ω	½W	5%	477-1-470Ω
R203, 204					
208	Metal Oxide	27k	½W	5%	477-1-27k
R206, 207	Metal Oxide	22k	½W	5%	477-1-22k
R209	Metal Oxide	18k	½W	5%	477-1-18k
R211	Metal Oxide	1k8	½W	5%	477-1-1k8
R212	Metal Oxide	33k	½W	5%	477-1-33k
R213	Wire Wound (see instrument parts list)		2½W	5%	Welwyn W21
R214	Metal Oxide	270Ω	½W	5%	477-1-270Ω
R216	Metal Oxide	3k3	½W	5%	477-1-3k3
R217	Wire Wound (see instrument parts list)		2½W	5%	Welwyn W21
R218	Metal Oxide	2k7	½W	5%	477-1-2k7
R219, 220	Wire Wound	0·1Ω	2½W	5%	Welwyn W21
R221, 222	Metal Oxide	1k5	½W	5%	477-1-1k5
R223, 224					
225	Metal Oxide (see instrument parts list)		½W	5%	
RV201, 202	Variable	22k			Morganite 62V
RV203, 204	Variable	1k			Morganite 62V
RV205, 207	Variable	100Ω			Morganite 62H
RV206	Variable	10k			Morganite 62H
Capacitors					
C201, 204	Electrolytic	250μF	64V	−10, +50%	Mullard C437 H250
C202, 203,					
205	Polystyrene	82pF	63V	20%	Suflex HS
C206	Polyester	22kpF	100V	20%	Wima FKS
C207	Polystyrene	1kpF	63V	20%	Suflex HS
Diodes					
MR201, 210, 211					Mullard BYX36-300
MR202	Zener				Mullard BZY88C9V1
MR203, 213	Zener				Mullard BZY88C5V6
MR204, 206					Mullard OA200
MR205, 208, 214					482-2
MR209	Zener				Mullard BZY88C15
MR212	Zener				Mullard BZY88C4V7
Transistors					
VT201, 202, 209					Mullard BC107
VT203, 204					Mullard BCY70
VT208					Mullard BFY50

PARTS LIST

Driver PCB W0684

Circuit Ref.	Description	Value	Rating	Tol.	Part No.
Resistors					
R101	Wire Wound	1k8	2½W	5%	Welwyn W21
R102	Metal Oxide	2k7	½W	5%	477-1-2k7
R103	Metal Oxide	1k	½W	5%	477-1-1k
R104	Metal Oxide	56k	½W	5%	477-1-56k
R106	Metal Oxide	15k	½W	5%	477-1-15k
R108, 109 114	Metal Oxide	3k3	½W	5%	477-1-3k3
R111	Metal Oxide	18k	½W	5%	477-1-18k
R112	Metal Oxide	180Ω	½W	5%	477-1-180Ω
R113	Metal Oxide	3k9	½W	5%	477-1-3k9
R117, 119	Metal Oxide	100Ω	½W	5%	477-1-100Ω
R118, 122	Metal Oxide	10k	½W	5%	477-1-10k
RV101	Variable	470Ω			Morganite 62V
VDR1	Voltage Dependent				Mullard E295 ZZ/02
Capacitors					
C101	Polystyrene	1000pF	63V	20%	Suflex HS
C102	Electrolytic	10μF	70V		Hunt AW1811A00
C103, 104	Electrolytic	64μF	64V		Mullard C437AR/H64
C106, 107	Polyester	22kpF	100V	20%	Wima FKS
C108	Filmite	6800pF	200V	10%	Sprague 192P68292
Diodes					
MR101, 102, 108, 111, 112, 113					Solidev 3A400
MR103	Zener				Mullard BZY88C9V1
MR104, 105, 106, 107, 109, 110					482-2
Transistors					
VT101, 102 103, 106					Mullard BC107
VT104					Mullard BFX29
VT107, 109					Newmarket NKT0039

Specification

utput: Type 761	0–15 V at 0–4 A or 0–30 V at 0–2 A or 15–0–15 V at 0–2 A Selected by mode switch
Type 762	0–30 V at 0–2 A or 0–60 V at 0–1 A or 30–0–30 V at 0–1 A
	The power supply circuit can be floated up to 300 V peak with respect to its case.
Line Supply	240V AC 230V AC 220V AC 110V AC ±10%, 48–60 Hz
	Connected via a captive 7 ft long plastic-covered three-core flexible supply lead.
Meter	2%, 120 mm (4.2″) scale length Type 761: scaled 0–4 A/0–30 V Type 762: scaled 0–2 A/0–60 V
onstant Voltage:	
Supply Line Regulation	<0.02% of maximum output for 10% AC change
Load Regulation	<0.05% of maximum output for 100% load change
Centre Tap Regulation	<0.05% for 100% load change over full range of output voltage. Tracking deviation typically 0.1% of maximum output voltage
Temperature Coefficient	Typically <0.02% per °C
Ripple & Noise	<1 mV p-p
utput Impedance	10 mΩ at 1 kHz
ansient Type 761 esponse	Recovers to within 50 mV in 30 μS for full load step change
Type 762	Recovers to within 50 mV in 20 μS for full load step change
Operating Temp. Range	0–45 °C
Dimensions	310 x 125 x 230 mm approximately 12.2 x 4.9 x 9 ins
Weight	7 kg (15 lbs) approximately

Description

The Maxireg 761, 762 Variable Power Supplies are robust, multi-purpose units designed to give long and trouble-free service. Front panels have been ergonomically designed and incorporate the following controls: On/Off switch with supply indicator light and fuse, output voltage/current meter with range selection switch, mode switch for selecting voltage range, calibrated voltage and current limit controls and 4mm colour-coded output terminals for spade and/or wire connection.

The centre tap terminal is effective only on the higher voltage range and provides a stable centre point which may be earthed to provide equal positive and negative supply rails.

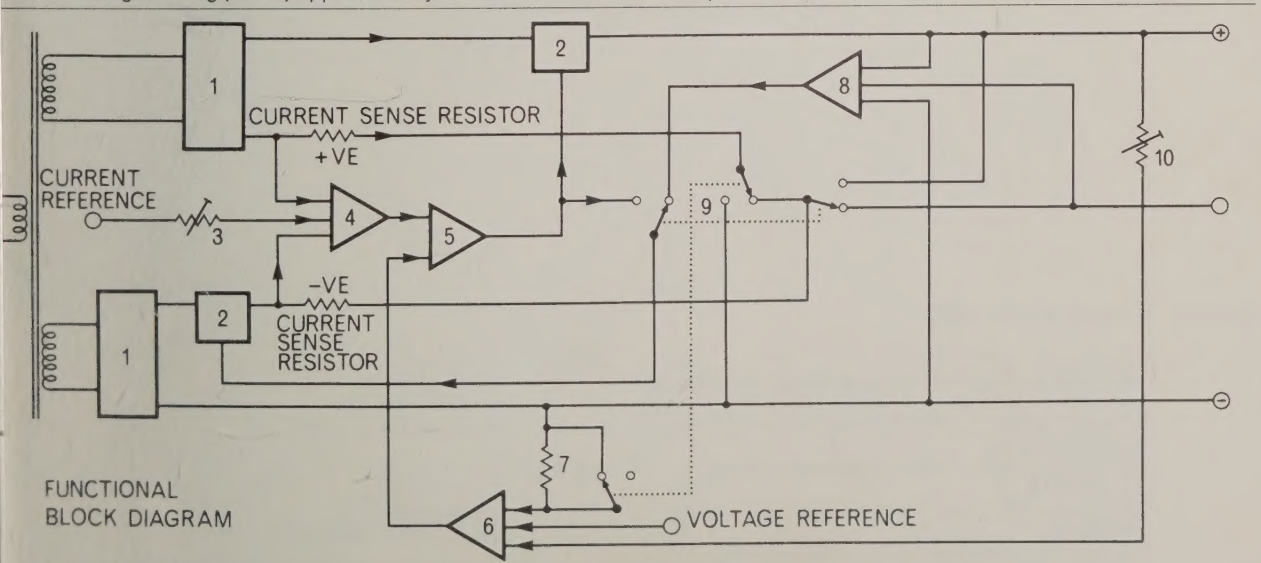
The large scale voltage/current meter may be used to measure output voltage, or positive or negative line current, as selected by a three-position switch. No change in output occurs when the meter is switched from voltage to current measurement.

Output voltage is set by a single-turn 3% calibrated potentiometer, giving continuous variation over the selected range. To safeguard circuits supplied by the unit, the calibrated voltage and current limit controls may be set at safe limits prior to switch-on.

In the centre tapped mode the current limit control operates on both rails if over-limit currents are drawn from either the positive or negative supply rail. Transient suppression facilities are incorporated ensuring only minimal output transients occur on changing voltage/current limit control settings or in changes of load or line supply.

Up to three units may be connected in series or parallel for higher current or voltage requirements.

The company reserves the right to alter specifications or prices without prior notification.

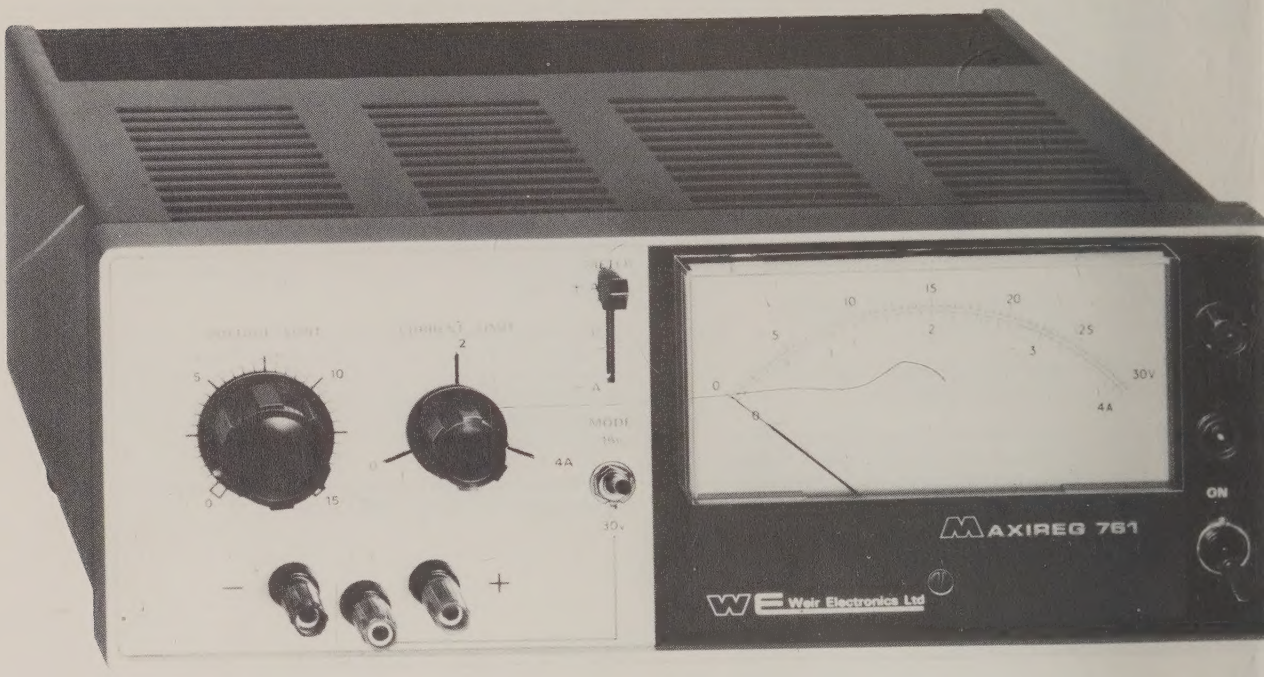


1 Rectifier and Filter
2 Series Regulator
3 Current Limit Adjust
4 Current Limit Amplifier
5 Gate and Buffer Amplifier
6 Voltage Limit Amplifier
7 Voltage Range Resistor
8 Comparator Amplifier
9 Mode Switch
10 Voltage Limit Adjust

Weir

Maxireg Variable Power Units

761
762



Maxireg Variable Power Units

Variable twin output mode.
Calibrated continuously variable voltage and current limit setting controls.
Constant voltage/constant current characteristics – short circuit proof.
120 mm (4.7″) 2% clear scale dual range voltage/current meter.
Output transient suppression and reverse polarity safeguards.
Fully rated at all load and control settings over 0–45°C ambient.

Type 761 0–15 V at 0–4 A
0–30 V at 0–2 A
15–0–15 V at 0–2 A
Mode switch selected

Type 762 0–30 V at 0–2 A
0–60 V at 0–1 A
30–0–30 V at 0–1 A
Mode switch selected

A robust and versatile unit of 60 watts maximum output designed to give long and trouble-free servi

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